Integrating low water energy and carbon sanitation technologies with sustainable small-holder farming in the Mopani municipal area: a pre-feasibility study

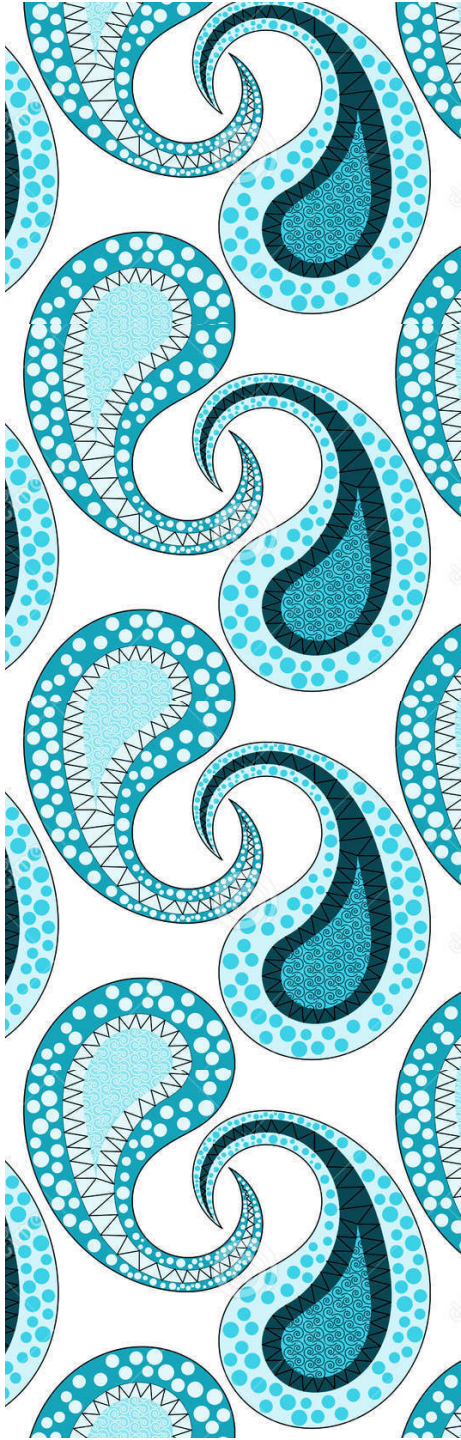
Presentation to the WRC by:

Attie van Niekerk	Nova Institute (Nova)
Erna Kruger	Mahlathini Development Foundation (MDF)
Betsie le Roux	Food and Water Research (Pty) Ltd (FAWR)

25 January 2021

Contents of this presentation

1. Background
   I. Expertise available
   II. Proposed project area
2. What are the outcomes of the project?
3. Is it a nexus project?
4. How will the project enhance community resilience?

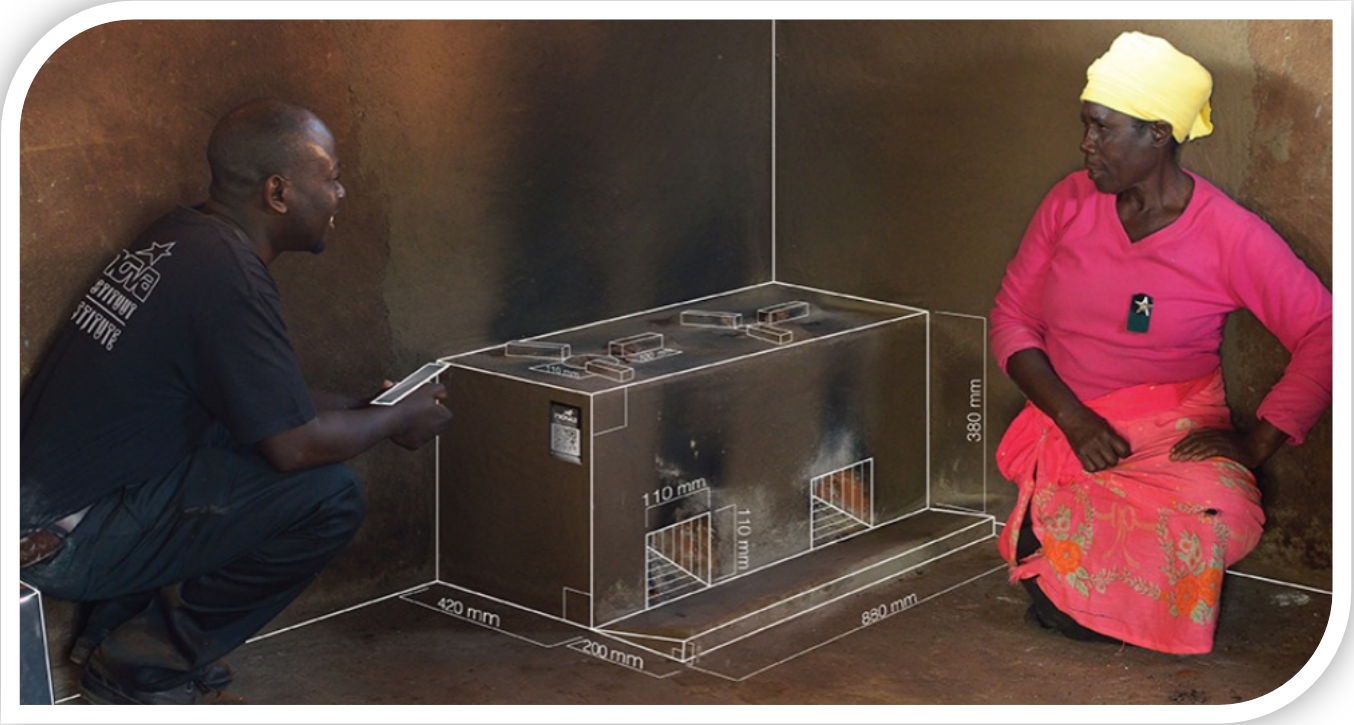


1. Background

Expertise available

Nova

- Work with **households** & **communities**
- **Integrate technology** into everyday practices
- Take practices **to scale**
- **25 years** experience



Brickstar stove

- **Co-designed** over **4 years** with residents**.**
- Reached **8 000 households** with more to come…

Mahlathini Development Foundation (MDF)

- Innovation system methodology in **climate resilient agriculture** implementation
- Decision support system for **local level community based CCA**
- Experience in promoting
  - Appropriate agricultural technology
  - **Soil and water conservation practices** at rural household level
- Development of:
  - **Local institutions** and **social agency** to collaborate in **water and resource conservation and management**
  - Local economic and food system solutions

mahlathini development foundation

Food and Water Research

- Experienced in
  - **Packaging decentralized sanitation technology** in a way that the small-holder farmers can engage with,
  - Waste and water quantity and quality management,
  - Development of **integrated water management**,
  - **Aquaponics** for **small-scale farmers**,
  - **Recovery of nutrients from waste** for use in **hydroponics**,
  - **Constructed wetland design for contamination control.**

FOOD& WATER RESEARCH

1. Background

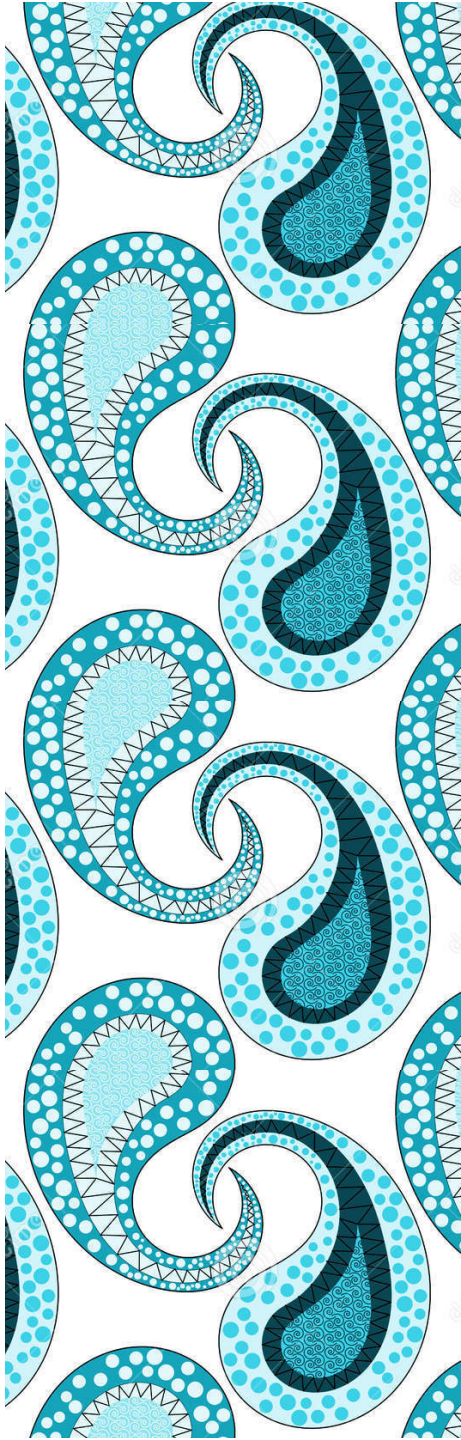
Project area

Mopani District (MD) Municipal Area

- MDF has relationships with **12 villages** in MD and expanding.
- **Small-holder farmers always experiment with MDF on different technical options.**
- Rural and peri-urban communities present. Thorough **integration of technologies into the daily practices** of one community of each type is needed to **upscale.**

Why decentralised sanitation?

- Mopani District is water scarce, flush toilets not feasible.
- Outcomes on a local level will be:
  - Survival strategies in water-stressed areas
  - Saving water
  - Cleaner sanitation
  - Better health
  - Increased food security



Question 1

Outcomes and products of the proposal

Project Phases

Current proposal

Preparation

- **1 year**
- Select:
  - Team
  - Households
  - Technologies

Co-develop

- **3 years**
- Co-create sanitation systems

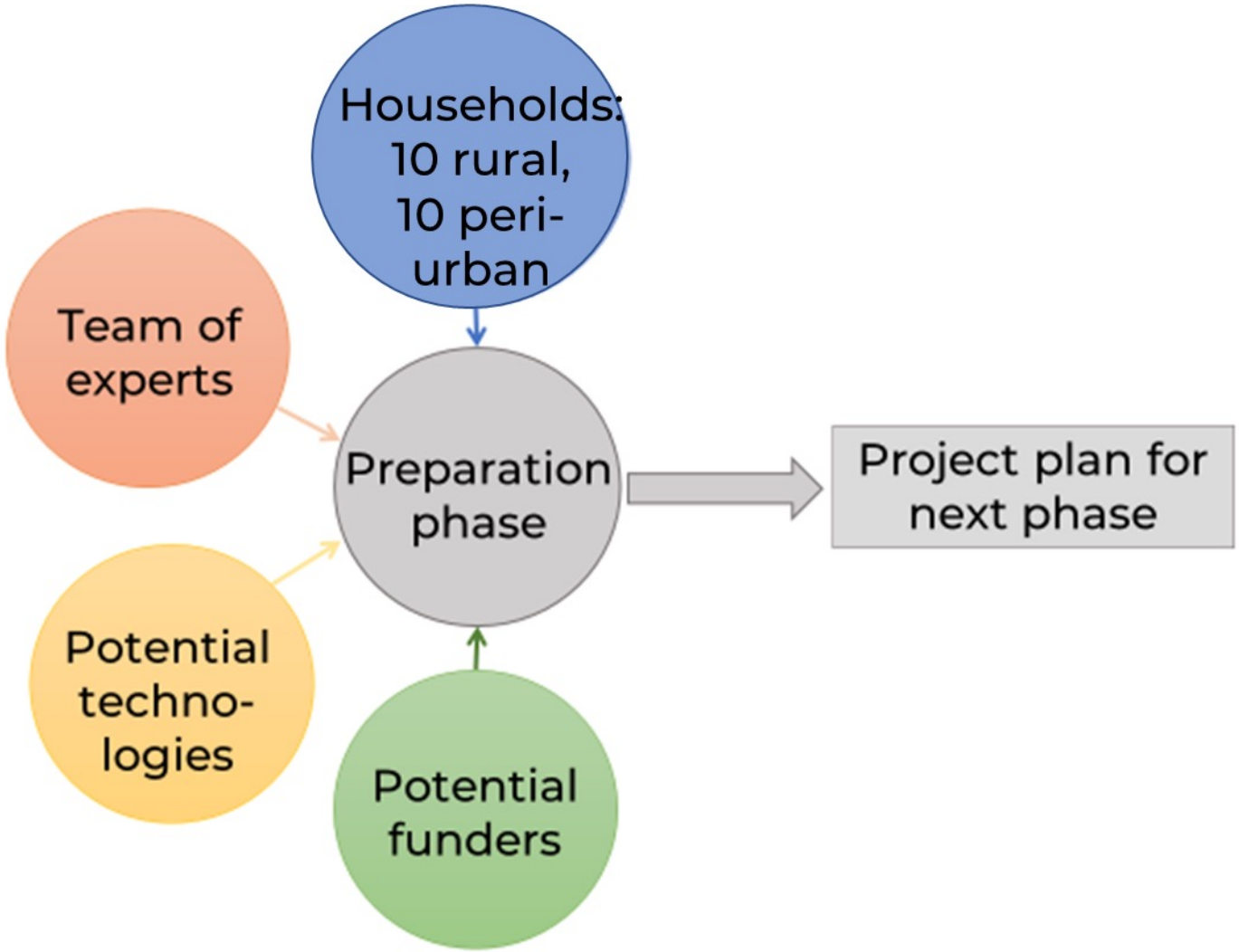
Pilot

- **4 years**
- Up-scale to municipal scale

Roll out

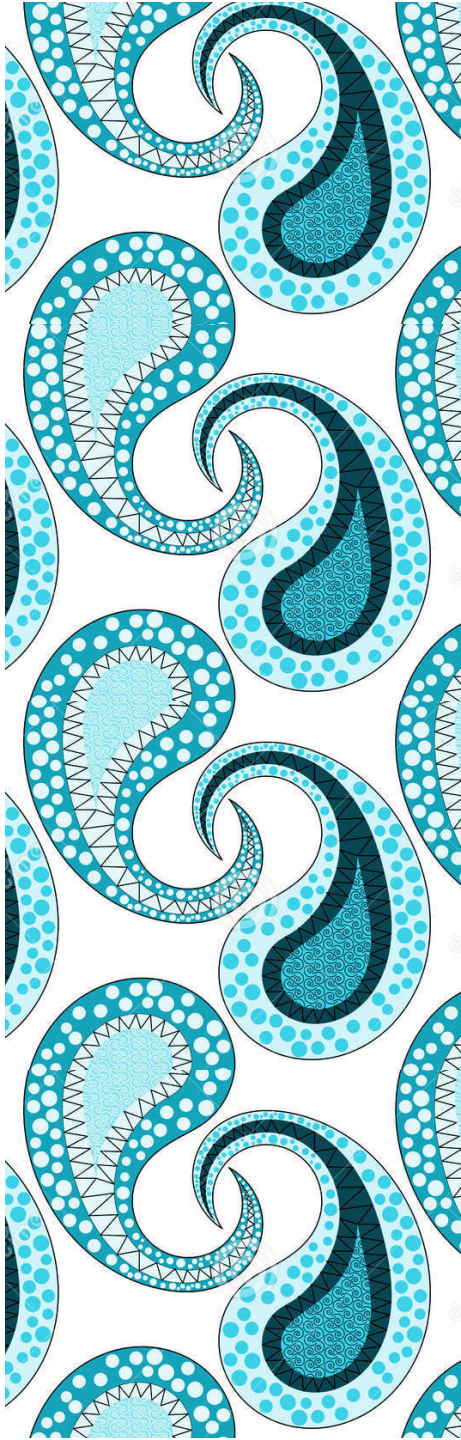
- **Continuous**
- Up-scale to other municipalities

Outcomes of preparation phase



Products of Preparation Phase

- Technical report
- Dissemination package



Question 2

Is it a nexus project?

Water – Energy – Food + Ecology & Health

Water

Food
(nutrients & irrigation)

Energy

Well managed sewage = Resource

Poorly managed sewage = Risk

Health risks

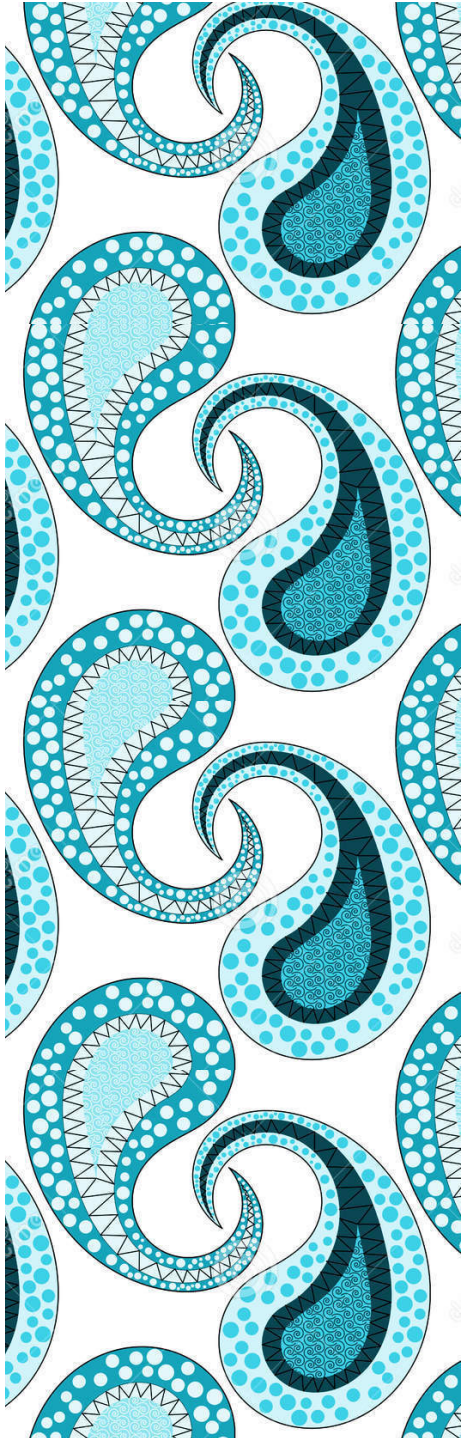
Ecological degradation

Eutrophication

Question 3

How will carbon sanitation enhance community resilience?

- **Integrated** activities: waste to resources
- Address **vulnerabilities**
  - Hunger
  - Floods
  - Droughts
  - Health and safety
  - Environmental (pollution, eutrophication)
  - Sanitation
    - Access
    - Maintenence
    - Disposal



Technology

Overloaded

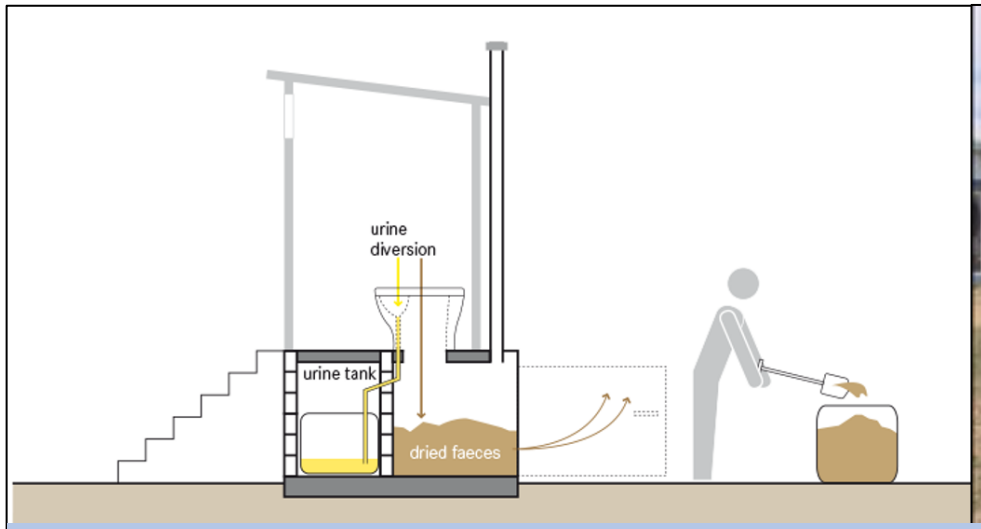
Versus

Agile

Thank you

Additional slides for discussion

Examples of potential options



USDDTs: Urine diversion dehydration toilets (>10 years, empty at annual intervals)

Low flush pit latrine, or low flush with leach chambers (shown below); 4 -10 years may need sludge removal

Urine diversion and collection for direct use in farming

Entrenchment of faecal sludge and planting of trees

Links to sustainable homestead crop production

- It is possible to use both urine and faecal matter (either dehydrated or sludge) in agriculture with important precautions
  - Dried faecal matter with use of lime or ash: Store for min 6months prior to use to reduce Ascaris contamination to zero – or entrench

Significant reduction in pathogens compared to sludge and much easier to handle. Nutrients are mainly carbon, P and K, used primarily for trees (fruit or timber, other perennials or field crops such as cereals. Minimal leaching

  - Faecal sludge: best method is entrenchment, with strong precautionary measures in handling

Use 1 m deep trenches. Also contains N alongside C, P and K. Minimal leaching

  - Urine: If stored in sealed containers only needs 5days-2months to reduce all

Nutrients are N, P, K and micronutrients, 2x more P and 8x more N than faecal matter). N:P:K ratio is 20:1,2:4. Also sterile but can be contaminated. Generally stored and then used directly on soil for irrigation. Need better solutions for local acceptability and practicalities of handling at homesteads.

How to incorporate the two P's into the farming system

- Handling has to be streamlined and minimized
- Potential danger of contamination has to be removed

= Use in trench beds at household garden and field level

For trees an perennial and fruiting crops and cereals.

Use 1 m deep trenches. These are already being prepared and filled with a range of organic materials. They are then left for a minimum of 6 years before re-doing, allowing for full composting and removal of faecal matter and pathogens, which takes a maximum of three years. Similar beds can be designed for planting of trees and other perennial crops

How will the project enhance community resilience?

- Together with the communities, the project team will aim to find the most suitable technologies for example:
  - Toilets that are physically safe for small children
  - Management of sewage that is safe, dignified, sustainable, and that does not lead to environmental pollution
  - Systems that can be built and managed by the community on site and independently, to enhance both short and long term sustainability
- The way in which the eventual practices are co-created with local small-holder farmers ensures that the solution is fully integrated into the local dynamics of the community: local solutions that will be locally produced, managed, implemented and maintained – with a minimum of outside support – unlike large scale systems where residents are fully dependent on outside powers
- Resilience is enhanced through appropriate planning of placement and waste management systems to reduce danger of flooding, leaching, ground water contamination and to allow for systems that use no or very little water to improve water use efficiency.
- Both fecal matter and urine can be safely used for fertility enhancement and improved crop production; in this case the link can be made directly with entrenchment and trench beds as promoted through the CRA decisions support process also designed under the WRC.
- Local methods for preferred and optimized use and handling can be explored and used as a pilot for expanding first within villages and then at a larger scale. If methods can be developed that do not need sludge removal significant gains in local health, reduced pollution and reduced use of energy and water can be effected.
- Exploration of cost effective solutions allow for cheaper options at a local level and significant savings in the system as a whole
- Ways of utilizing sewage as a resource in energy production will be considered.
- Vulnerabilities
  - Hunger
  - Floods
  - Droughts
  - Health and safety
  - Environmental (pollution, eutrophication)
  - Sanitation
    - Access
    - Maintenence
    - Disposal